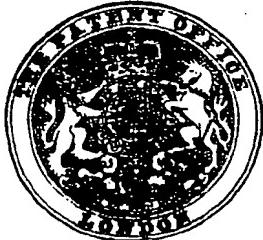


PATENT SPECIFICATION

DRAWINGS ATTACHED

897,717



Date of Application and filing Complete Specification: March 17, 1961.

No. 9787/61.

Application made in United States of America (No. 22146) on April 14, 1960.

Complete Specification Published: May 30, 1962.

Index at acceptance:—Class 99(2), P1A(9:12:14:15B:16B:19B:23B), P1B7.

International Classification:—F06l.

COMPLETE SPECIFICATION

Flexible Conduits

We, ELECTROLUX CORPORATION, a corporation organized and existing under the laws of the State of Delaware, United States of America, located at 51 Forest Avenue, Old Greenwich, State of Connecticut, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

Our invention relates to hose or other flexible conduit and more particularly to a hose of substantial diameter in which is incorporated an electric cord.

When such a hose is bent the linear distance along the surface of the hose on the inside of the bend is necessarily less than the linear distance along the outside of the bend, this being made possible by contracting and stretching of the hose material at the respective sides if the material is elastic, as it usually is, accompanied by deepening and flattening of corrugations at the respective sides of the hose. Consequently, if an ordinary copper conductor is incorporated in the side wall of a hose, copper being substantially inelastic, it will not permit the stretching of the material in the event the conductor is on the outside of the bend, while if it is on the inside it will not contract but will be bent into short loops so sharply that it may be weakened to the breaking point after a relatively few bends.

It has been suggested to incorporate the conductors in a spiral within the hose, but this requires a conductor length many times that of the hose which not only adds to the cost and weight, but also increases the voltage drop through the conductor.

In accordance with the present invention there is provided a hose including a hollow tubular body made of flexible material, a stretchable electric conductor extending substantially parallel to the centre line of said body, and means for securing said conductor to said body at closely spaced points, said

conductor being elongated prior to being secured to said body sufficiently so that when said hose is bent with said conductor on the inside of the bend the conductor contracts and remains substantially parallel to said centre line. 50

One advantageous application of our invention is to tank type vacuum cleaners when it is desired to transmit electricity from the main unit to a motor located in a nozzle which is connected to the unit by means of a suction hose, although it is to be understood that our invention may be used with various other types of hose. 55

In the accompanying drawings:

Fig. 1 is a side view, partially broken away, of a vacuum cleaner hose embodying our invention;

Fig. 2 is a cross-sectional view on an enlarged scale of a section of the hose illustrated in Fig. 1 and showing a reverse bend in the hose;

Fig. 3 is a cross-sectional view of a slightly modified form of hose and is taken on the line 3—3 of Fig. 4;

Fig. 4 is a cross-sectional view taken on the line 4—4 of Fig. 3;

Fig. 5 is a cross-sectional view similar to Fig. 2, but showing our invention embodied in a different type of suction hose;

Fig. 6 is a view on a smaller scale and partially in cross-section of the hose illustrated in Fig. 5, but showing coupling members at the ends of the hose, the cross-sectional portion being taken on the line 6—6 of Fig. 7;

Fig. 7 is a cross-sectional view taken on the line 7—7 of Fig. 6;

Fig. 8 is a top view of a portion of the hose shown in Figs. 6 and 7; and

Fig. 9 is a cross-sectional view similar to Figs. 2 and 5, but showing our invention embodied in a third form of hose. 85

Referring more particularly to Figs. 1 and 2, reference character 10 designates generally a flexible hose which is provided at one end 90

- with a push connector 12 for removably connecting it to a vacuum cleaner, and at the other end with a rigid tubular member 14 for connecting it to a suction cleaning tool.
- 5 The construction of the flexible hose 10 is shown more particularly in Fig. 2. It includes a tubular member 16 made of fabric impregnated with rubber or other suitable material to make it airtight. The fabric is preferably cut on the bias so that it is somewhat elastic in the lengthwise direction of the hose. Within the tubular member 16 is a supporting spiral wire 18 made of steel or other material of suitable strength. The turns of the spiral 18 are preferably secured to the inner surface of the tubular member 16, as by vulcanizing during the construction of the hose. A cord or string of jute 20 or other suitable material is spirally wound around the outside of the tubular member 16, the turns of the string 20 being in between the turns of the spiral 18, as is clearly shown in Fig. 2.
- Prior to winding the string 20 around the tubular member 16 a piece of stretchable two conductor cord 22 is laid along side of the hollow body and extends in a straight line substantially parallel to the center line of the hollow body. Prior to winding the string 20 around the hollow body 16 and the cord 22, the latter is elongated to the extent and for the reason which will subsequently be explained. The string 20 thereupon serves to secure the conductor cord 22 to the tubular body 16 at spaced points along the length of the cord, namely at each point where the cord is held between the tubular body 16 and a turn of the string 20.
- Thereafter, the tubular body with the conductor cord attached is provided with a braided cover 24 by means of a known braiding machine. The ends of the cord adjacent to the opposite ends of the hose are not secured in place by the string 20, but are covered by the braiding 24. However, these ends may be brought out through the braiding, as is shown in Fig. 1, by inserting a hook shaped instrument between the strands of the braiding, catching the free end of the conductor cord and pulling it out. A male plug 26 may be secured to one end of the cord, any desired length of free cord 22a being provided. The other end 22b of the conductor cord may be secured to a receptacle 28 which is fixed to the end of the hose by means of the clamp 30.
- 55 When in use, the push connector is engaged with a suitable inlet opening in the vacuum cleaner unit and the plug 26 is inserted in an electrical outlet on the unit, the free portion 22a permitting a certain amount of swiveling of the push connector 12 in the inlet opening. A suitable cord from the nozzle is provided with a male plug which is inserted in the receptacle 28, thus completing the circuit from the unit to the nozzle.
- 60 65 As will be seen from Fig. 2, when the hose

extends straight the distance a between successive turns of the spiral 18 is approximately $3/16$ of an inch. On the other hand, the distance b between adjacent turns of the supporting spiral 18 at the inside of the bent portion of the hose is only about $\frac{1}{8}$ of an inch while the distance c between adjacent turns of the spiral 18 at the outside of the bend is approximately $\frac{1}{4}$ of an inch. This means that if the conductor cord 22 is on the inside of the bend it must contract from $3/16$ of an inch to $\frac{1}{8}$, or approximately 33%. In order to be able to do this it must have been elongated at least 33% of its normal unstretched length before it was secured to the tubular body by means of the string 20. If the conductor cord is on the outside of the bend it must stretch about the same amount, or 33%, which readily may take place, as it is capable of a total elongation of at least 200%.

The embodiment illustrated in Figs. 3 and 4 is the same as that previously shown, with the exception that the stretchable conductor cord 22 is disposed between the overlapping edges 16a and 16b which form the longitudinally extending seam of the fabric of the tubular body 16. An advantage of this arrangement is that the outer edge 16b of the seam provides additional protection for the cord 22. As in the previous embodiment, a braided cover 24 encases the tubular body 16 and the stretchable cord 22.

In the embodiment illustrated in Figs. 5 to 8, the tubular body of the hose is designated by reference character 32 and is a tube of flexible plastic material. This tube is supported against collapse by the stiff spiral wire 18. Disposed between adjacent turns of the spiral and the inner surface of the tubular member 32 is the stretchable cord 22. As was the case in the previous embodiments, the cord 22 is elongated prior to being secured between the turns of the spiral and the tubular body by an amount sufficient so that when the hose is bent with the cord on the inside of the bend it may contract and thus remain substantially parallel to the center line of the hose.

Inasmuch as the plastic tubular member 32 constitutes the airtight portion of the hose, it is not practical to bring the cord 22 through it to the outside thereof adjacent to the ends of the hose, as this would permit leakage of air. As is shown in Figs. 6, 7 and 8, the cord is continued to the ends of the tubular body 32, the ends being secured within the push connector 12 and the rigid tubular member 14, respectively, as was the case in Fig. 1. As is shown at the right-hand end of Fig. 6, and in Figs. 7 and 8, the cord after it emerges from the tubular member 32 is bent back on itself and extends along the outer surface of the tubular member to a point beyond the end of the push connector 12. Preferably, a semi-cylindrical member 34 of rubber or plastic is placed over the hose at this end and has a

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5 relatively thin portion 35 extending between the hose and the inner surface of the push connector. The thin portion is formed with a groove 36 connecting with a channel 37 in the thicker part of member 34 within which extends the cord 22. The cord is preferably provided with a free section 22a to the end of which is connected the plug 26.

10 The same construction may be employed at the opposite end of the hose, with the exception that the free section 22b of the cord is connected to a receptacle 38.

15 In the embodiment illustrated in Fig. 9 the hose comprises an inner tubular member 40 of airtight flexible plastic material and an outer body 42 of similar material between which is disposed a reinforcing fabric 44. The stretchable cord 22 is disposed between the fabric 44 and the inner tubular member 40, 20 it having been elongated prior to being secured therein, as previously described.

25 In this embodiment the cord may be brought out through openings formed in the outer tubular body 42 adjacent to the ends of the hose similar to the manner shown in Fig. 28, inasmuch as the inner body 40 is airtight and would prevent leakage. On the other hand, the cord may be continued to the ends of the hose and brought out through semi-cylindrical members as is illustrated in the previous embodiment.

30 Although the stretchable cord 22 has been referred to as having two conductors, it is to be understood that it may have any desired number from one up, depending upon electrical considerations. Also, even though our invention has been described in connection with various forms of suction hose, it is equally applicable to flexible conduits of other types.

40 WHAT WE CLAIM IS:—

45 1. A hose including a hollow tubular body made of flexible material, a stretchable electric conductor extending substantially parallel to the center line of said body, and means for securing said conductor to said body at closely spaced points, said conductor being elongated prior to being secured to said body sufficiently so that when said hose is bent with said conductor on the inside of the bend the conductor contracts and remains substantially parallel to said center line.

50 2. A hose according to claim 1, including a spirally wound reinforcing wire within said body.

55 3. A hose according to claim 1 or 2, including a braided cover around said body.

4. A hose according to claim 3, wherein said conductor extends outwardly through said

cover adjacent to the opposite ends of the hose, and there are electrical connector members secured to the ends of said conductor outside said cover.

5. A hose according to claim 3 or 4, wherein said conductor is secured between said body and said cover.

6. A hose according to any one of the preceding claims, including a cord wound spirally around said body to secure said conductor thereto.

7. A hose according to any one of claims 1 to 4, wherein said body has a longitudinally extending overlapped seam, and said conductor is secured between the overlapped portions of the material of said body.

8. A hose according to claim 3 or 4, wherein said body has a longitudinally extending overlapped seam, said conductor being secured between the overlapped portions of the material of said body, and said braided cover being around said body and said conductor.

9. A hose according to claim 2, wherein said body is made of airtight plastic material, said conductor being secured to said body by being disposed between successive turns of said spiral wire and said body.

10. A hose according to claim 1, 2 or 9, including a coupling member telescopically secured over each end of said body, the ends of said conductor projecting out of said body at each end thereof and extending back between the outer surface of said body and the respective coupling member and beyond the latter, and electrical connector members secured to the ends of said conductor.

11. A hose according to claim 2, wherein said body is made of airtight plastic material, and there is a second hollow tubular body around the first said body, said conductor being disposed between said bodies and secured thereto by the force exerted by successive turns of said spiral wire.

12. A hose substantially as described herein and with reference to Figures 1 and 2 of the accompanying drawings.

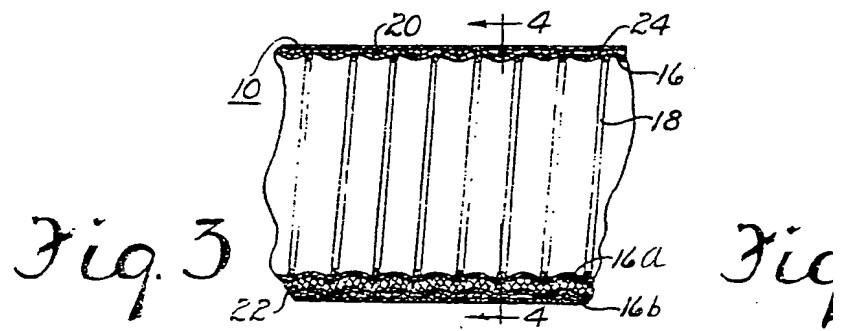
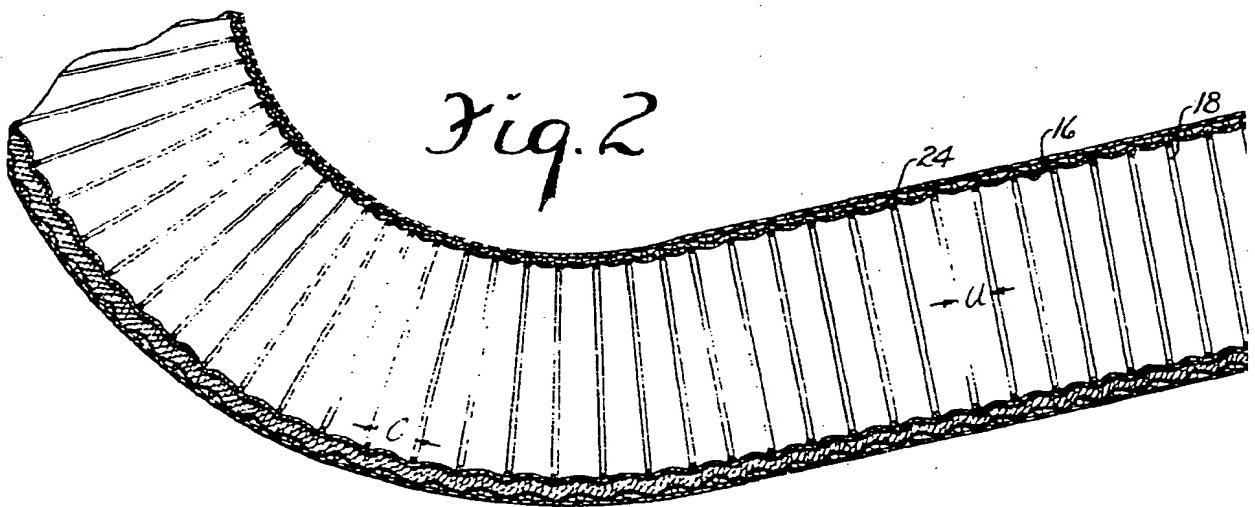
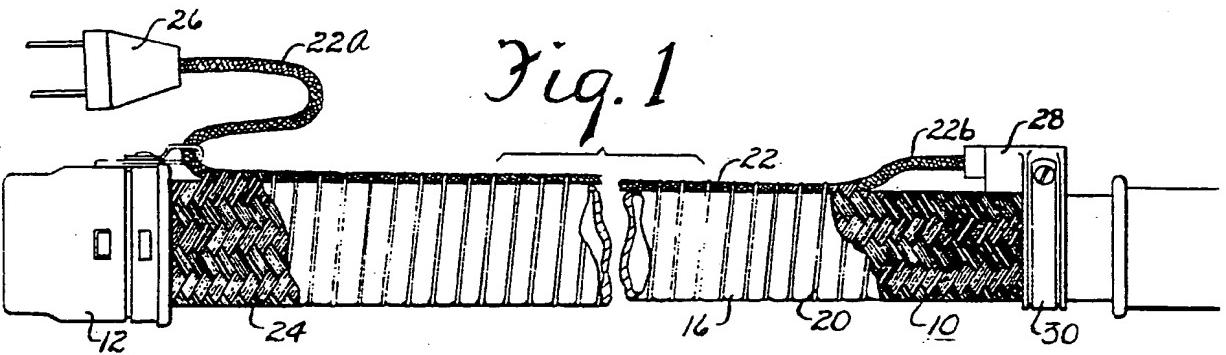
13. A hose substantially as described herein and with reference to Figures 3 and 4 of the accompanying drawings.

14. A hose substantially as described herein and with reference to Figures 5 and 8 of the accompanying drawings.

15. A hose substantially as described herein and with reference to Figure 9 of the accompanying drawings.

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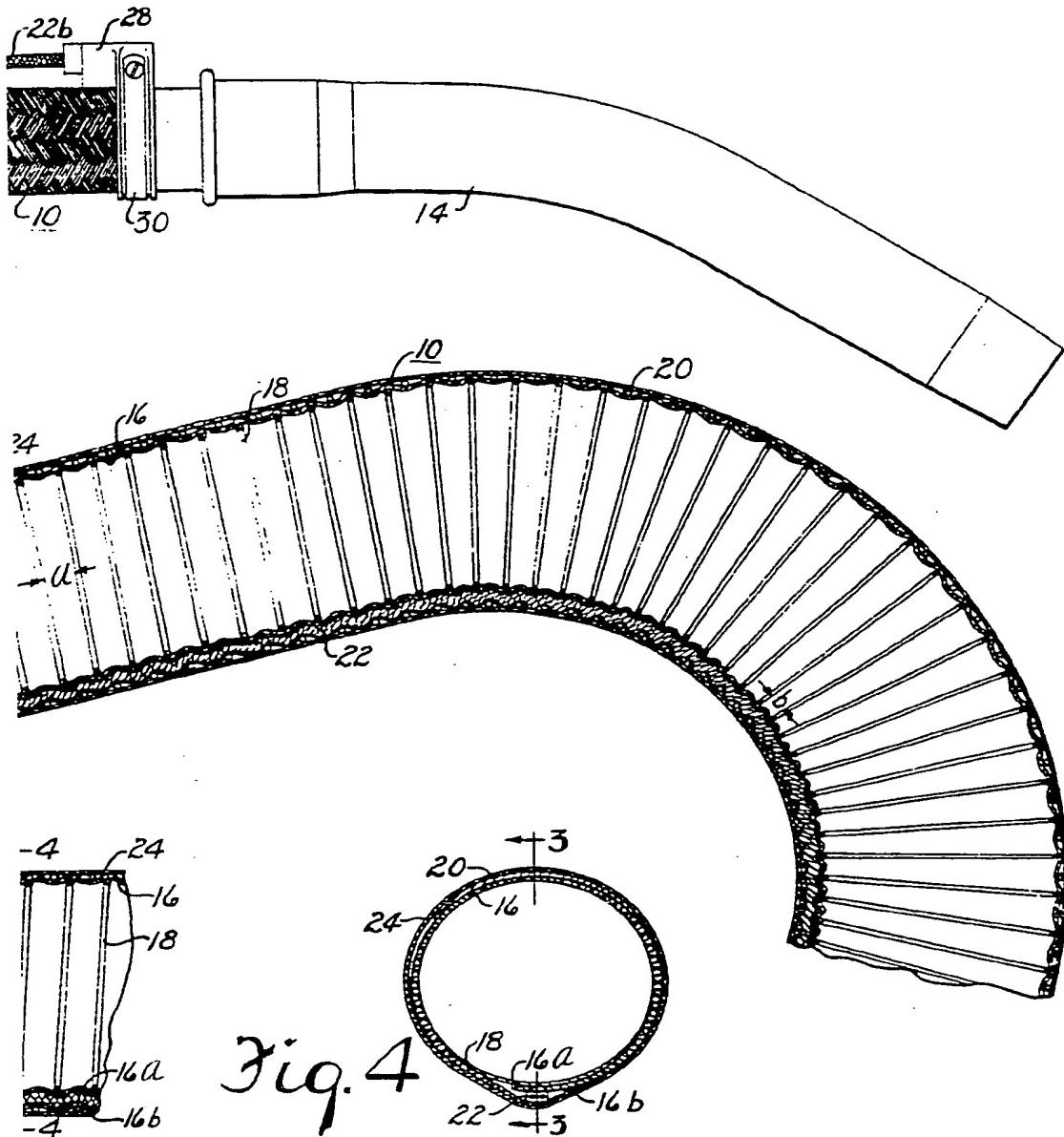


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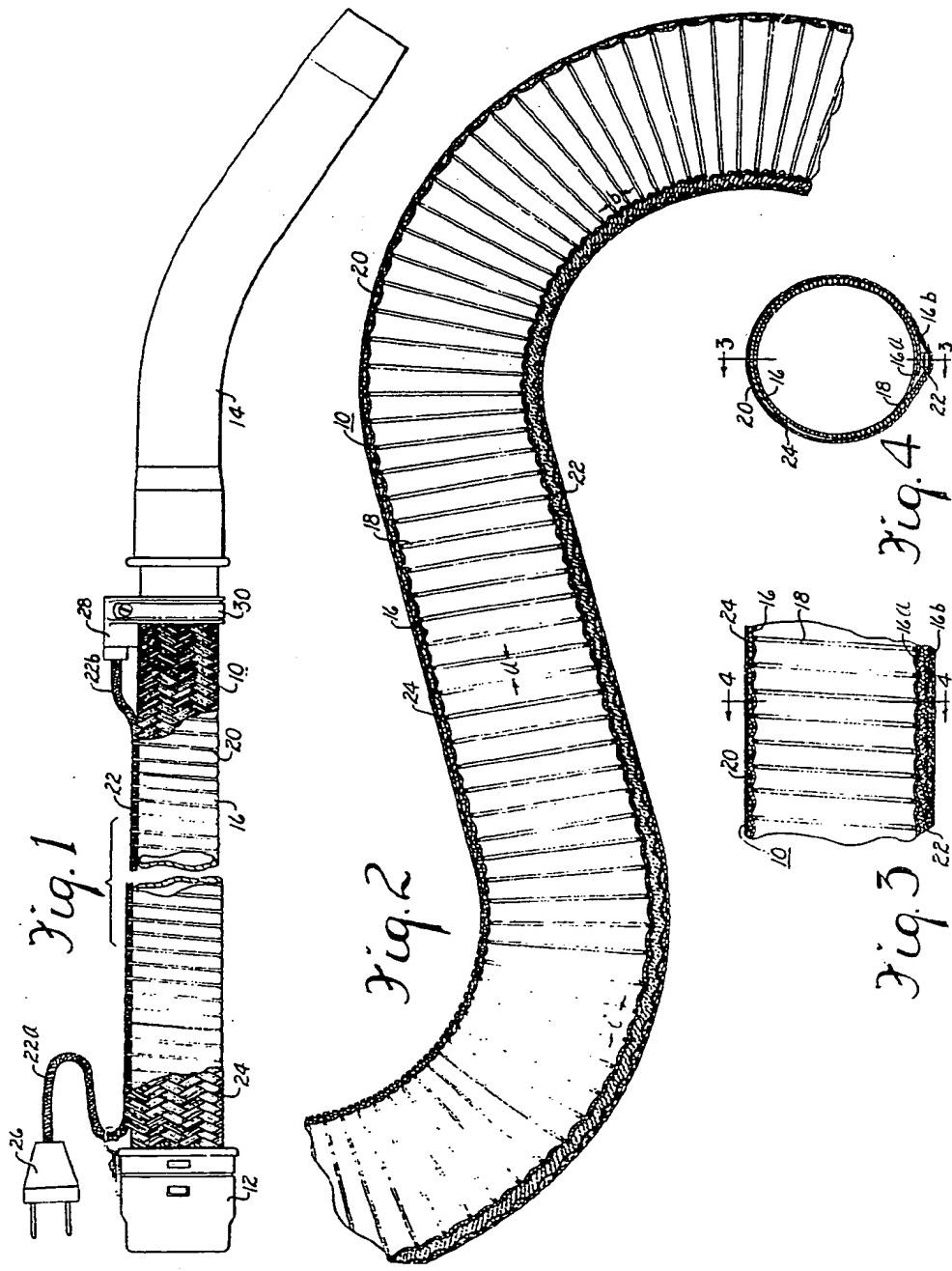
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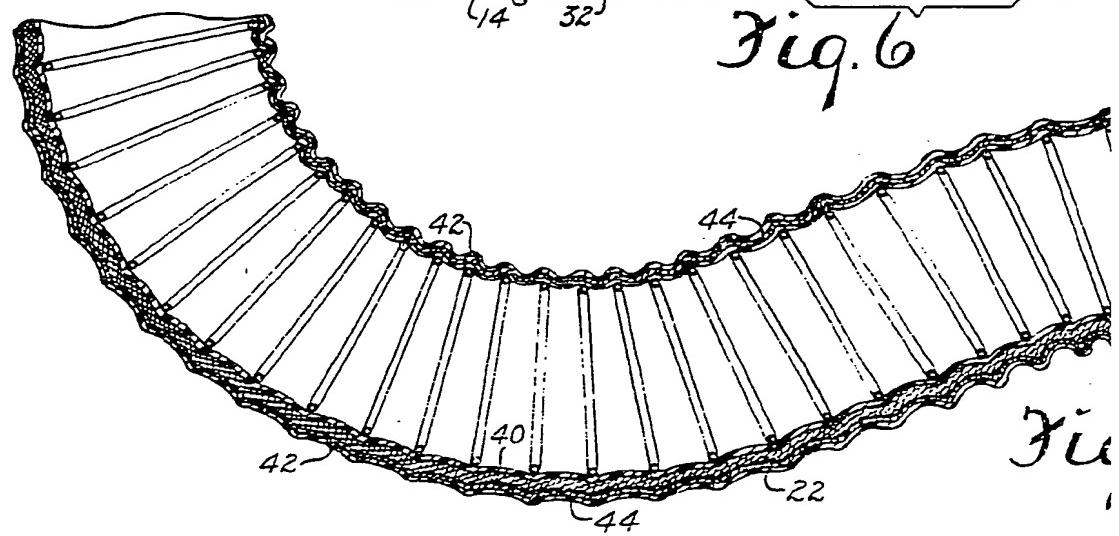
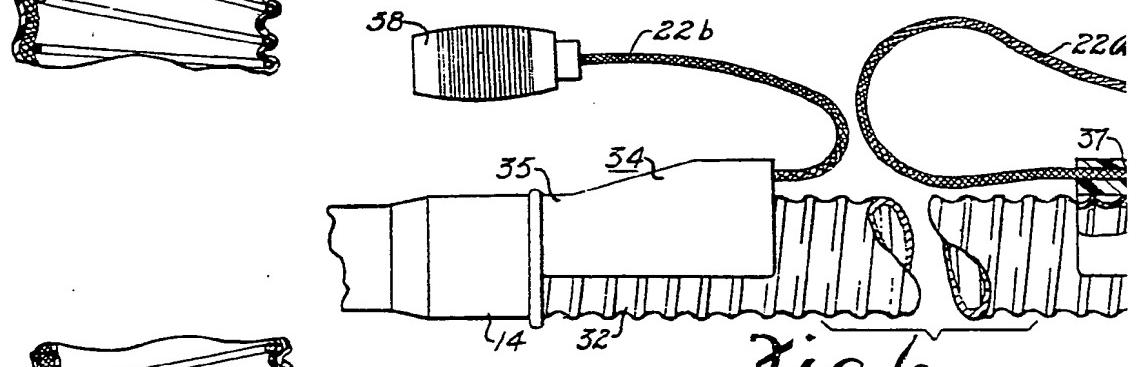
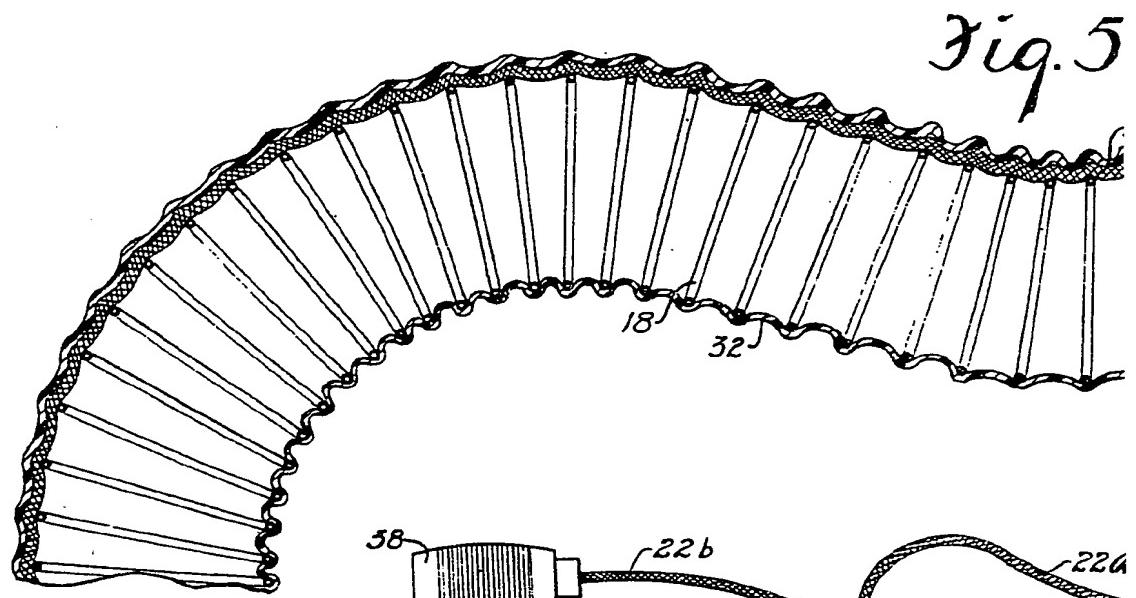
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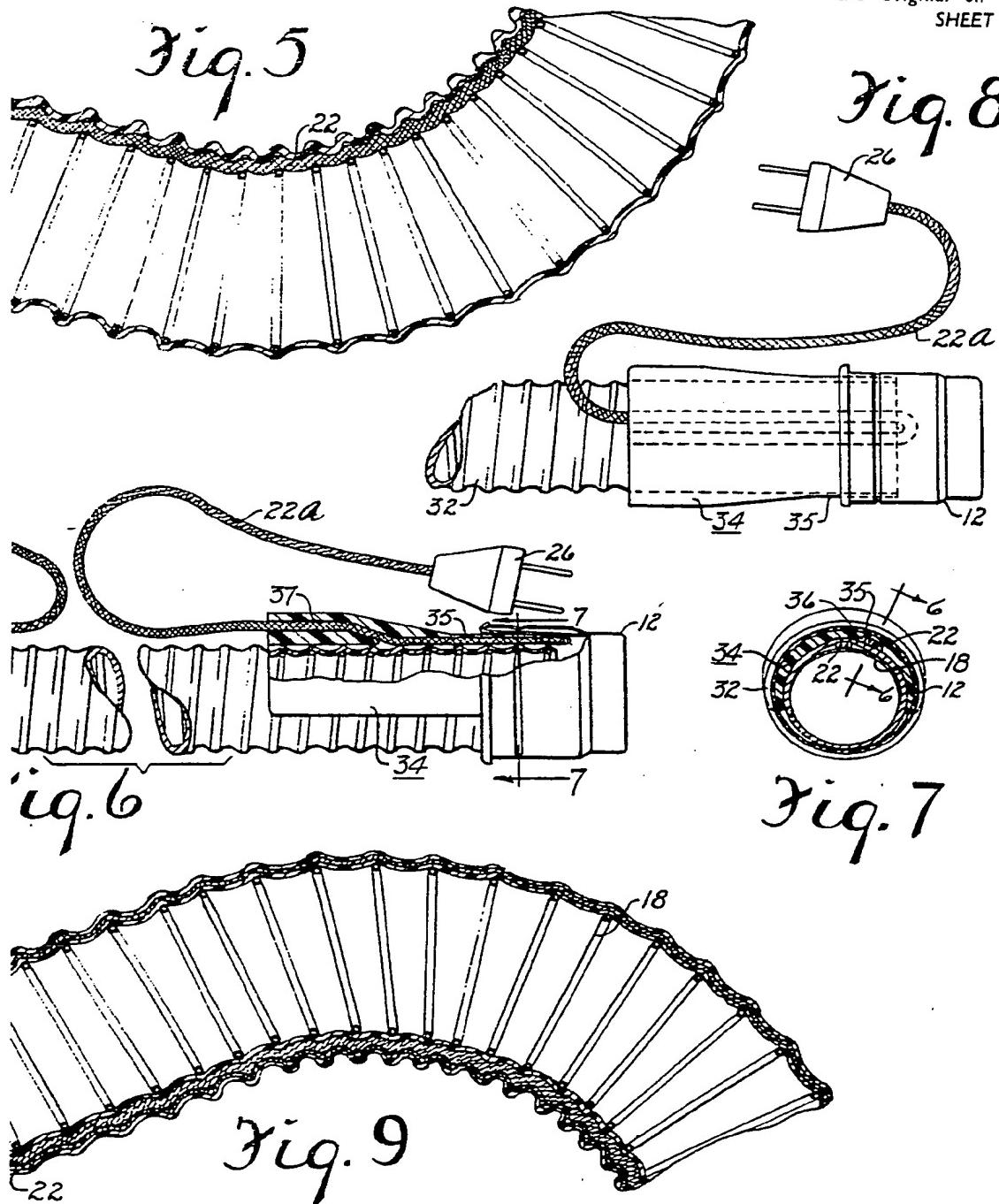




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